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Revised ORR Machinery Index

I. New vs. Old ORR Machinery Index.

The handbook, ~~Soviet Industry~~, provides a greatly expanded coverage of civilian machinery production which changes some of the machinery sector indexes and the overall machinery index. Table 1, below, compares the new index with the index calculated by ORR prior to the handbook. The sectors which are based directly on the production series in Soviet Industry are indicated by a footnote. Merchant shipping is based on I/SR estimates. The electronics index is that given by the Soviets for the Radio-Technical Ministry and accepted by I/EE in the absence of anything better. The weight for electronics is the value of output in 1955 rubles estimated by I/EE. The military end items index is major programs procurement from I/ME's cost study, excluding R & D and nuclear energy, plus operating spares.

The new index for civilian machinery production is substantially lower than the old index.

Significant downward revision occurred in agricultural equipment, electric power equipment, and consumer durables. Metal forming equipment was significantly increased. Sectors where the sample coverage was already nearly complete have not been changed much; automotive equipment, tractors, machine tools. The expansion of the sample coverage also noticeably increased the weights for the slow growing sectors, agricultural equipment, and railroad equipment.

The other important factor which slows down the index is the extension of coverage to new sectors most of which are slower growing. The converse of this extension of coverage is the reduction of weight for electronics which is very rapidly growing and had an excessive effect on the growth of the old index.*

II. Description of New Index. (See Appendix)

A. The ORR index can be described as a gross value index of major machinery end items. This is true of the old as well as the new index, but the coverage of the former is much smaller. Thus it differs from the FRB index of the machinery sectors which is a value-added weighted index

* Its effect on the new index is not trivial.

Table 1

Soviet Machinery Production

GNP Indexes in 1955 Prices

1950=100

	OLD INDEX		NEW INDEX	
	1955 Index	1950 Weight Percent	1955 Index	1950 Weight Percent
Motor Vehicles (inc. mil. autos.)	142	23.5	148 a/	18.6
Tractor Building	130	11.9	152 a/	8.4
Agricultural Machine Building	199	4.6	122 a/	9.7
Railway Machine Building	86	5.6	84 a/	14.2
Metal-cutting Machine Tools (1955 mix)	167	12.9	170 a/	12.0
Forging-pressing machines (1955 mix)	176	3.9	201 a/	1.0
Electric Power Equipment	238	12.6	155 a/	3.9
Boiler Equipment and Primary Engines	-		249 a/	.3
Construction and Road Work Equipment	-		139 a/	2.5
Hoist-Transport Equipment	-		178 a/	1.2
Metallurgical, Mining, Fuel-Refining and Chemical Equipment	-		162 a/	5.8
Textiles, Leather and Publishing Industry Equipment	-		122 a/	1.2
Consumer Durables, excluding Radio and TV	353	8.2	308 a/	6.2
Civilian Shipbuilding	162	2.5	162	3.2
Electronics (inc. mil. elect.)	435	14.3	441	11.8
Civilian total, including military automotive equipment & electronics	221	100.0	186	100.0
Military end items, excluding military automotive equipment & electronics	-		145	
Civilian, excluding military automotive equipment & electronics	-		173	46.3
Military end items, including automotive equipment & electronics	-		156	53.7
Total	-		164	100.0

a. Based on production series in Soviet Industry

of both end items and intermediate goods. It also differs from the Soviet index which is a gross value index of all machinery production with substantial double counting.

B. Coverage.

The coverage by the Industry handbook is very good as far as civilian producer durables is concerned. By industry the omissions can be listed from a Soviet industrial classification (Savinsky). These are:

Communications equipment (electronics)

Equipment for woodworking and paper

Equipment for food industry

Shipbuilding

Civilian aircraft

Control and measurement instruments

Fire prevention, safety, air compression, medical, office and other equipment

The only important ones are electronics, shipping and possibly instruments.

The total value of output of producer durables given in the handbook (as priced in the index) for 1955 is ~~25~~ 22 bil 1955 Rubles. This compares with 46 bil 1955 Rubles given as the value of producer durables (tools and equipment) in investment for 1955 in the National Economy handbook. When ORR estimates of industrial electronics and merchant ships are added the sum is ~~33~~ 29 bil Rubles. The investment producer durables would include some non-machinery.

One major kind of production that is largely missing from the index is spare parts. In the tractor industry at least there is evidence that spare parts production was sizeable and more rapidly growing than complete tractors. The ORR estimates of electronics and mil. end items do include spare parts.

C. Weights.

1. The index is composed of physical production series multiplied times 1955 wholesale prices. There is no adjustment of the weights of the sectors within the non-military portion. The overall index is simply the sum of the individual value series. Since coverage of the production sample varies from industry to industry some bias of unknown direction is present.

However since coverage appears to be very good for eight largest sectors the error, on this account, is not likely to be large.

The weights for combining the non-military index with military index were adjusted. The weight for non-military was assumed to be equal to the value of tools and equipment in investment* plus the value of consumer durables, 32 bil 1955 Rubles in 1950.

The weight for military is the calculated value of hard goods procurement (ex AE, ex R&D), 37 bil. Rubles in 1950.

The use of 1955 price weights involves some understatement of growth, for the period 1950-1955 as compared to the use of earlier year prices. The use of prices of an intermediate year (1952 in the case of the Soviet index) would be preferable. The effect of different prices was tested by construction of 1950 weighted indexes where 1950 prices were available.

Table 2

1950 vs. 1955 Price Weights

Sector	1950 Prices 1955/1950	1955 Prices 1955/1950
Electric power equipment, excluding electric motors	160	155
Metal cutting machine tools, 1950 mix	176	175
Tractor building	165	152
Motor vehicles, including passenger	153	148
Total	160	153

2. Selection of Prices.

Actual model prices or the prices for representative models were carefully selected by respective branches of D/I for auto equipment, tractors, agricultural equipment, metal cutting tools, metal forming tools, electric power equipment, RR equipment, and consumer durables. Average price per ton for metallurgical equipment was estimated by D/I. Average price per ton for chemical equipment was calculated from a Soviet announcement, first half 1957, of chemical equipment in rubles and for

* Producer durables investment differs from producer durable machinery production by a time lag, by the inclusion of non-machinery equipment, by the exclusion of the bulk of spare parts, and on account of exports and imports.

1956 in tons and the growth from 1956 to 1957. The price per ton of petroleum equipment was assumed equal to that of chemical equipment.

For the remaining series, textile and publishing equipment, construction equipment, hoist-transport equipment, boilers and primary engines, median model price minus one (model) was selected. One hopes that the errors of this procedure are partially compensating.

D. The Measurements of Output.

The most difficult problem in constructing a machinery index is finding a unit of measurement of output for the complex and diverse items produced. This is exemplified in the extreme by custom-built machinery. Thousands are produced but no two are alike. The introduction of new types or designs poses the same problem. Conceptually there is no solution.

A related problem is that in practice output is likely to be reported by categories and classes which mask a great deal of diversity. This is true of the FRB index. It is especially true of the ORR index of Soviet machinery where it is based on the categories and classification detail of the Soviet announcements. This varies from excellent to frightful. In the case of automotive equipment and tractors, precise production by model is available. For agricultural machinery and railroad equipment models are relatively few in number and the model predominately produced in any year is known for many of the categories announced by the Soviets. At the other extreme is machine tools in which thousands of models are represented by 17 categories, including one called "Special, specialized and unit type machine tools." Metal forming tools are represented by seven categories. One of these, presses, includes an extreme diversity of size and cost. In other cases the production series are announced in terms which partially reflect diversity; i. e., turbines and generators in KW, metallurgical equipment, petroleum equipment, and chemical equipment in tons.

The significance of the output classes and measurement units is their adequacy in reflecting complexity changes. The Soviet gross value index fully reflects complexity growth (which was rapid in the USSR in the period 1950-1955). Each piece of machinery produced is added into

the gross value index at its specific 1952 price. For new models since 1952 the initial price is inflated to the 1952 level by some price index. It is clear that the initial price setting is potentially a source of overstatement of complexity change.

The two major sector indexes which are not based on handbook production series, electronics (Soviet value index) and armaments, do reflect complexity increases. The CSR index, where it is based directly on Soviet physical production announcements, reflects complexity very poorly. In these sectors it is broadly similar to the FRB index in this respect. Most sectors of the FRB index have a much more detailed breakdown than the corresponding sectors for the USSR. Machine tools are in 67 categories in the FRB index. These categories, however, are organized by use, not by complexity, i. e., lathes, drills, grinders, etc. The final category is an "other" category which includes most of the unique custom built tools, and amounted to about 10 percent of the value of shipments in 1954. This category is measured by value of shipments deflated by an average unit value index of the rest of the machine tool index.

A more glaring example is passenger cars which is represented by total number of cars in the FRB index.

The periodic revisions of the FRB index, of which the last introduced 1947 weights and product mix, incorporate major new product categories, such as television sets. This, however, is quite a different thing than the steady, undramatic product improvement (or, at least, complication) within established product categories, such as automobiles, tractors, farm equipment, machine tools, etc.

III. Evaluation of the CSR Index.

A. Comparison with the Soviet Index.

The CSR machinery index is substantially below the Soviet index and the sectors are similarly below the selected indexes for the branches of the machinery industry announced by the Soviets, as the table below shows:

Table 3

1955 Indexes of Machinery Production
1950=100

Selected Sectors a/	ORR Index (1955 prices)	Soviet Gross Value Index
Metal cutting machine tools	170	377
Forging-pressing machines	201	
Electric power equipment	155	367
Boiler equipment and primary engines	249	305
Tractor building	152	224
Agricultural machine building	122	203
Motor vehicles	148	193
Railway machine building	84	166
Construction and road work equipment	139	241
Machinery Total	164	243

a. The sectors shown are those given on page 203 of Soviet Industry.

The sectors in the table are those for which Soviet Industry gives both a value index and a sample of physical production.

The measurement of complexity is clearly an explanation of a substantial part of the discrepancy in the case of machine tools. But for automotive equipment and tractors, production and price* by model is known. Their discrepancies hence must stem from differences in coverage and from double counting in the Soviet index.

The detailed coverage of the Soviet branches of industry is unknown. But the fact that all ORR sectors are below the corresponding Soviet sector or, in the absence of the latter, below the overall Soviet index means that shifts of items from branch to branch could not reduce the overall discrepancy. Items missing from the ORR index, such as spare parts, might reduce discrepancy.

An increase in the degree of double counting will inflate the Soviet index. The Soviets talked a great deal about the desirability of plant specialization and subcontracting, but they were notably unsuccessful in achieving this, with the important exception of aircraft production, and

* Note, however, absence of 52 prices.

possibly electronics. Nevertheless an increase in double counting can happen in subtle ways. The electronics industry is vertically specialized much more than other industries. This gives an excessive gross value weight to this very rapidly growing industry. Most tractor engines are made at the same plant as the chassis. Production of the Belorus tractor was initiated during the period and grew rapidly at a plant of the defense ministry which purchased its engines from another plant. Thus the increase in engines was double counted. Increases in complexity would lead in many cases to increasing double counting. As more electric motors, ball bearings, electronic components and precision instruments are incorporated in various end item designs the more rapid component growth would be double counted.

Finally, some of the discrepancy in the overall index may simply represent erroneous ORR (and service) estimates of military end items. It seems unlikely that these are underestimated in 1955, but they may have been overestimated in 1950.

B. An Estimated Range.

The index in table 1 is in 1955 or end of period prices. Table 2 suggests that a rough correction corresponding to a change to mid-period prices would be 4 percentage points. The new machinery index would then be 1955/1950=168. This is a possible index. But in the light of both data and conceptual difficulties outlined above no claim to precision can be made.

The ORR index is unlikely to be substantially too high, since it is not much above the indexes for ferrous and non-ferrous metals. It may, however, be too low. An illustrative "high" alternative is presented below.

1. The comparison of Soviet and US industrial growth by indexes which suppress complexity growth is excessively unfavorable to the USSR, since complexity growth there for 1950-1955 was certainly larger than in the US. In the ORR index complexity growth is already probably fully reflected in electronics and military end items. The other industry where complexity appears to be of major importance is machine tools. For the "high" alternative, the Soviet machine tool index (1955/1950=377) is substituted for the ORR metal cutting tool and metal forming tool indexes.

2. Assume that spare parts would raise the rate of growth. The only indication we have that these are important is in the tractor industry.

Therefore for the "high" alternative the Soviet tractor index (1955=224) is substituted.

3. Assume that land armaments were overstated in 1950. In "high" alternative the value of these in 1950 is cut in half (i. e., by 6 billion rubles).

4. Finally 4 points are added to the index as an assumed correction to mid-period price weights.

The resulting index is ~~184~~ 194 plus 4 = ~~188~~ 198. A suggested range for the index of Soviet machinery output is then 168-~~188~~, 196.

Value of Production of Machine Building
By Industry Category, 1950-1955

Thousands of 1955 Rubles

Category	1950	1951	1952	1953	1954	1955
Producer Durable:						
Boiler Equipment and Primary Engines (excluding Diesels)	74,112	88,590	123,216	156,056	164,806	184,586
Electric Power Equipment (excluding Electric Motors)	894,553	1,013,744	1,093,641	1,287,055	1,273,110	1,390,626
Metal Cutting Machine Tools (1955 Mix)	2,759,050	2,642,720	2,602,170	3,049,630	3,440,920	4,689,460
Forging-pressing Machines (1955 Mix)	225,346	282,479	295,943	341,176	385,205	452,533
Metallurgical, Mining, Fuel-Refining and Chemical Equipment	1,330628 ~~1,560,588~~	1,614,660 ~~1,845,788~~	2,039,668 ~~2,289,508~~	2,427,534 ~~2,742,534~~	2,312,651 ~~2,651,771~~	2,160,305 ~~2,556,905~~
Equipment for Light Industry	199,993	186,614	202,053	211,443	274,917	258,872
Printing and Publishing Equipment	65,103	70,034	72,851	84,444	71,662	63,516
Construction and Road Work Equipment	581,651	555,497	556,979	583,976	698,523	807,293
Hoist-transport Equipment	264,719	309,585	326,816	411,082	446,515	470,869
Agricultural Machine Building	2,226,053	2,611,583	2,121,064	1,954,420	2,350,627	2,712,784
Tractor Building	1,919,860	1,589,635	1,774,500	2,006,580	2,426,825	2,914,210
Railway Machine Building (including passenger)	3,251,312	2,356,448	1,793,630	2,273,856	2,441,773	2,730,372
Motor Vehicles (including passenger) (Inc. mil. auto)	4,279,270	3,772,750	4,122,980	4,872,780	5,747,310	6,341,845
Total Producer Durable	18 071 651 ~~18,309,630~~	17 094 279 ~~17,325,399~~	17 125 511 ~~17,375,351~~	19 660 032 ~~19,975,932~~	23 034 844 ~~23,373,964~~	25 177 271 ~~25,567,871~~
Consumer Durable (excl. turnover tax)	1,644,192	2,122,009	2,495,071	3,140,174	4,532,775	5,777,601
Radio and TV	218,458	249,205	199,995	447,485	929,405	1,388,670
Total Durable	~~19,953,862~~ 19,715,842	~~19,447,408~~ 19,216,288	~~19,870,422~~ 19,620 582	~~23,115,206~~ 23,800,206	~~26,906,739~~ 26,567,619	~~31,345,472~~ 30,954,872

Production Indexes -- Machine Building
By Industry Category, 1950-1955

(1950=100)

Category	1950	1951	1952	1953	1954	1955
Producer Durable:						
Boiler Equipment and Primary Engines (excluding Diesels)	100	120	166	211	222	249
Electric Power Equipment (excluding Electric Motors)	100	113	122	144	142	155
Metal Cutting Machine Tools (1955 Mix)	100	96	94	111	125	170
Forging-pressing Machines (1955 Mix)	100	125	131	151	171	201
Metallurgical, Mining, Fuel-Refining and Chemical Equipment	100	~~118~~ 121	~~146~~ 153	~~175~~ 182	~~169~~ 174	~~163~~ 162
Equipment for Light Industry	100	93	101	106	138	129
Printing and Publishing Equipment	100	108	112	130	110	98
Construction and Road Work Equipment	100	96	96	100	120	139
Hoist-transport Equipment	100	117	124	155	169	178
Agricultural Machine Building	100	117	95	88	106	122
Tractor Building	100	83	92	105	126	152
Railway Machine Building (including passenger)	100	72	55	70	75	84
Motor Vehicles (including passenger) (inc. mil. auto.)	100	88	96	114	134	148
CMR Computed Machine Building (Producer Durable only)	100	95	95	109	122	~~140~~ 139
Consumer Durable including radio and TV:	100	129	152	191	276	351
Radio and TV	100	114	142	205	425	636
Total Durable	100	97	100	116	135	157
USSR Official-Machine Building	100	120	140	169	200	243

Appendix 2

Production Items and Units of Measurements in

GNP Index

The list below gives the individual civilian production items from Soviet Industry which are included in the GNP index:

Automotive equipment:	
Trucks	Units, by model
Buses	" " "
Passenger cars	" " "
Tractors	
Agricultural Equipment:	
Plows, tractor-drawn	Units
Plows, tractor-mounted	"
Plows, shallow, tractor-drawn and mounted	"
Harrows, tractor-drawn	"
Cultivators, tractor-drawn	"
Cultivators, tractor-mounted	"
Drills, tractor-drawn and mounted	"
Planters, potato, tractor	"
Transplanters	"
Combines, grain, tractor-drawn	"
Combines, grain, self propelled	"
Windrowers	"
Combines, corn	"
Combines, flax	"
Combines, potato	"
Combines, beet	"
Cotton pickers	"
Mowers, tractor-drawn	"
Mowers, tractor-mounted	"
Rakes, tractor-drawn	"
Threshing machines, complex & semi-complex	"
Grain cleaning machines	"
Straw cutters, ensilage cutters, & straw-ensilage cutters	"
Feed preparation aggregates	"
Combines, ensilage	"
Cultivators, horse-drawn	"
Rakes, horse-drawn	"
Fodder steamers	"
Railroad Equipment:	
Mainline locomotives:	"
Steam	Units, by model
Diesels	Units
Electric	
Mainline freight cars:	"
Refrigerator 4-axle	"
Boxcars, 4-axle	"
Flatcars, 4-axle	"
Gondolas, 4-axle	"
Tankcars, 4-axle	"
Cement cars, 4-axle	"
Mainline passenger cars	"
Trolley cars	"
Machine tools:	
Lathes	"
Turret lathes	"
Automatics and semi-automatic lathes	"
Milling machines	"
Gear making machinery	"
Boring machines	"
Planers	"
Shapers	"
Slotters	"
Broaching machines	"
Grinding machines	"
Tool grinders	"
Vertical drills	"

Appendix 2 (continued)

Radial Drills	Units
File machines	"
Spec., specialized, and aggregate	"
Grinders, polishers, bolt threaders, tapping, etc.	"
Metal forming:	
Hammers	"
Presses	"
Forging machines	"
Shears	"
Bending and straightening	"
Other	"
Electric power equipment:	
Steam and gas turbines:	
Up to 25 thousand KW	KW
25-49 thousand KW	"
50 thousand KW	"
100 thousand KW	"
150 thousand KW	"
Hydraulic turbines:	
Large	"
Medium	"
Small	"
Generators for steam turbines	"
Generators for hydroturbines	"
Transformers, power	KVA
Electric lamps	Units
Boilers and primary engines:	
Steam boilers:	
High capacity	sq. meters
Medium capacity	" "
Low capacity	" "
Construction equipment:	
Excavators:	
Multi-bucket	Units
Single-bucket, by capacity:	
0.15	"
0.25	"
0.35 - 0.75	"
1	"
2	"
3 - 6	"
10 or more	"
Bulldozers	"
Tractor scrapers	"
Concrete mixers	"
Motor graders	"
Hoist-transport equipment:	
Railroad cranes	"
Truck cranes	"
Tower cranes	"
Pneumatic tire cranes	"
Elevators	"
Mining, metallurgical equipment:	
Metallurgical equipment:	Tons
Rolling mill equipment	"
Coal combines	Units
Coal cutting machines	"
Rock loading machines	"
Electric mine cars	"
Petroleum equipment	Tons
Deep well pumps	Units
Turbo drills	"
Chemical equipment	Tons
Industrial electric furnaces	Units
Textile, leather & publishing equipment:	
Carding machines for cotton	"
Spinning machines for	"
Reeling machines	"
Looms	"
Circular hosiery automatics	"

Appendix 2 (continued)

	Units
Industrial sewing machines	"
Finishing machines (leather footwear)	"
Tieing machines (leather footwear)	"
Type-setting machines	"
Flat-bed printing presses	"
Consumer durable:	
Clocks and watches	"
Motorcycles	"
Bicycles	"
Household sewing machines	"
Cameras	"
Phonographs	"
Television sets	"
Indoor loudspeakers	"
Refrigerators	"
Washing machines	"
Radio receivers:	
Class I	"
Class II	"
Class III	"
Class IV	"
Vacuum cleaners	"
Electric toasts and percolators	"
Electric stoves	"
Electric irons	"
Kerosene stoves	"